"WRITTEN SO YOU CAN UNDERSTAND IT."

# POPULAR MECHANICS

**An Illustrated Weekly Review of the Mechanical Press of the World**

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## THE OIL WONDER OF THE WORLD

**Great Geysers which Spout 70,000 Barrels Daily**

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## GREATEST OIL WELLS IN THE WORLD.

### History of the Texas Oil Field—Present Capacity 5,000,000 Barrels Daily.

Ever since the white man invaded Texas he has observed in different parts of the State little pools of water on which floated a thin scum of oil. In some places this scum thickened into a paste which was used for axle grease. About six years ago some wells were sunk at Corsicana, which were increased to nearly 500. These wells produce about 12 barrels each per day when pumped.

In the spring of 1890 a stranger drifted into Beaumont, Texas, which is in Jefferson county, the southeast corner of the State; and about 150 miles southeast of Corsicana. This man was Capt. Lucas. He brought with him a steam drilling outfit and commenced work two miles from town on a little rise of ground. He was the laughing stock of the country for miles about, and when some three months later he gave up the undertaking as a bad job he had plenty to remind him they "had told you so." He left his "well" and shipped his outfit away and was quickly forgotten.

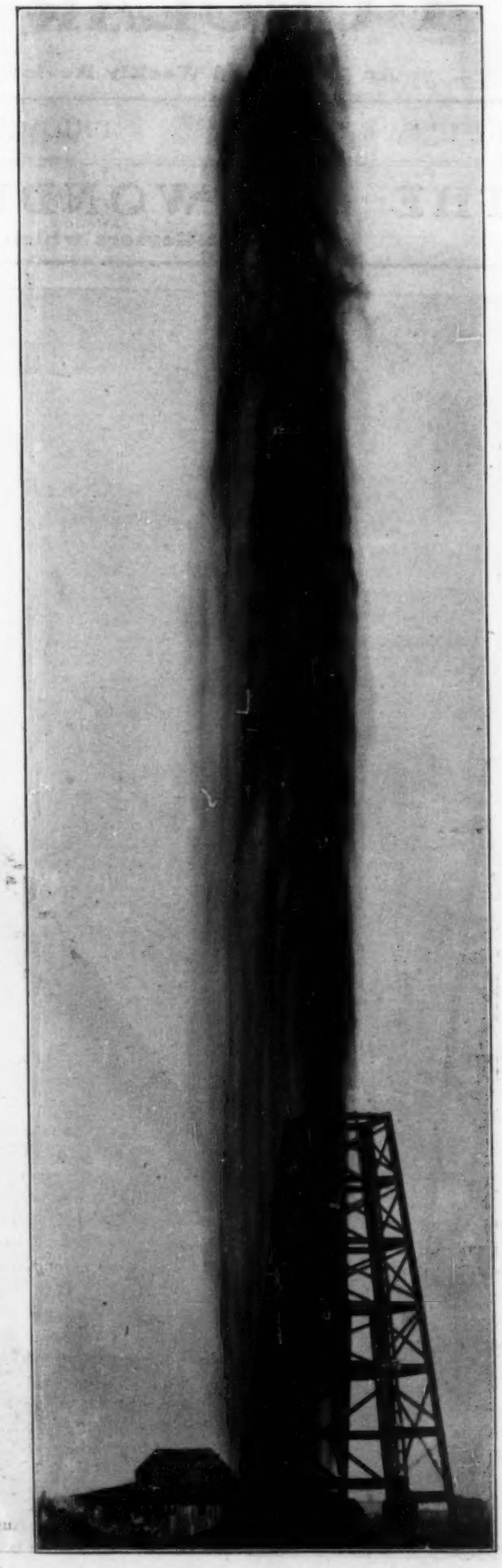
Several months later two strangers arrived and began buying land "for a rice farm," paying from $3 to $6 per acre for the unimproved land. They did not have much money, but it happened that what they did buy was adjoining the little piece where the Lucas folly had been. The land secured, to the surprise of every one, Capt. Lucas again appeared, bringing back the drilling outfit, and determined to try it once more. The drill had been running only a few days when, on January 10th, 1901, oil was struck, the derrick blown to pieces by the discharge, and Capt. Lucas in an instant became the biggest man in Texas. He dipped his drill in oil and wrote it indellibly in history alongside that of Fremont, the gold finder. Incidentally his three and six-dollar land in a few months was selling for $250,000 an acre.

But to return to the well. After doing all the damage possible it continued to spout its solid stream of oil nearly 200 feet into the air, and discharged something like 50,000 barrels every 24 hours. The whole country was threatened with the oil deluge. People from town and country joined hands in a fruitless effort to stop or even control the flow. Still it spouted on with undiminished power. An artificial lake was formed covering several acres, and men and teams worked night and day raising earth banks to restrain it. Finally after 10 days of perilous work, the well was capped, the valve closed and the monster was a captive. And not a moment too soon. The next day the lake containing half a million barrels of oil took fire, the flames rising 500 feet in the air, while the smoke was carried up thousands of feet and was visible for miles. Such is the thrilling story of the greatest oil discovery in the world's history.

The story of the few following months is one of almost unparalleled activity. Prospectors and investors by thousands swarmed into Beaumont. For want of other accommodations business was transacted in the streets, where for weeks, thousands surged from 4 a. m. until the next morning at two o'clock, buying and selling lands. Owners of lands previously worth only a few dollars per acre found ready buyers at as many thousand dollars an acre.

As fast as money and men could do the work, other oil geysers were "brought in" until now, in less than 13 months from the first strike there are some 130 of them capable of producing from 30,000 to 70,000 barrels each per day. If all the wells were allowed to flow the total output is estimated at not less than 5,000,000 barrels per day. There have been no "dusters" (dry wells) in the proven field, which is about half a mile wide and a mile long.

To sink a well a strong derrick 69 feet high is first erected. A portable boiler and two small steam engines are set. One engine does the hoisting, the other pumps water, for the Beau-



mont wells are bored with a rotary drill and not as so many eastern wells were sunk, by lifting and dropping a sharp pointed weight. Two sets of heavy pipe are used. The outer one for the casing usually six or eight inches in diameter, and a smaller one which is suspended inside. The smaller pipe has an augur device at the bottom end, and is turned from left to right; at the same time water at 40 pounds pressure is pumped through it, washing the borings up through the larger pipe and flowing away at the mouth of the well. At a depth of about 1,000 feet oil commences to flow out with the water. Strong valves are then attached at the top and work continued with care. Finally the "cap rock" is pierced and the great underground lake of oil struggles to escape under a pressure of 400 pounds to the square inch. The supply seems inexhaustible and the pressure is as great today as a year ago.

As in every such discovery many companies were formed more for the purpose of selling stock, than for legitimate production. This has been unfortunate and a great injury to those concerns which are actually engaged in oil business and not mere stock jobbers. A marvelous amount of work has been accomplished, nearly 200 miles of pipe lines have been laid, several reaching to tide water where great ocean vessels load in a few hours with a cargo of 50,000 barrels at a time, for Europe. Thousands of tons of well piping have been required; great iron tanks erected with an aggregate capacity of millions of barrels storage; and hundreds of tank cars built. A refinery is now being erected with a capacity of 30,000 barrels a day.

While the oil refines into the usual petroleum products, the greatest output will be for fuel. One railroad alone in the South will save $500,000 a year by burning oil instead of coal. Three barrels of oil equal one ton of good soft coal. It is only a question of time necessary to construct the transporting tank cars and tank ships to make Texas oil a condition certain to revolutionize the fuel question of the South, and to a large extent that of the entire country east of the Rocky mountains. It already has created great excitement in Europe.

Our front page illustration shows a well flowing an 8-inch stream a distance of 175 feet; the other spouting straight up in the air 210 feet. Both are 70,000 barrel daily wells. We are indebted to Geo. M. McKinney, Chicago, of the Southern Pacific Railroad for the photographs. Texas oil has already made hundreds rich, and is destined to enrich thousands more.

## TO PUMP AIR FROM THE SKY.

It is proposed to try an interesting experiment in the way of cooling the air at the international exposition to be held next year in St. Louis, says Age of Steel. The idea is to reduce the high temperature of the grounds during the summer months by drawing downward cool currents from an altitude of 800 to 1,000 feet above the ground and distributing over the fair grounds air from 10 to 15 degrees cooler than the surface temperature. The plan, according to a published description, comprehends the construction of an aerial tower or stand pipe of the aforesaid height, with lower termination about 50 feet above the ground, where large fans or blowers are attached that will draw a current downward at the rate of 20 or 30 miles an hour, equivalent to a pumping capacity of 500,000 cubic feet of air per minute. This volume of air will cover an acre 10 feet deep—in an hour 60 acres and in six hours 360 acres. After sundown the temperature, it is claimed, can be held below 80 degrees F. The fans are to be started at 4 a. m., when the air is coolest. By 10 o'clock the buildings and grounds would be filled with fresh air and so maintained during the day.

General Palmer, who presented Colorado Springs with Austin Bluff park for public use, did so with the proviso that no horseless carriages be allowed within the park.

## COST AND HANDLING OF GLUE.

**Cheaper and Better Grades Compared—Useful Figures About the Preparation.**

More than $7,000,000 annually is spent in the United States for glue and yet few people know how to buy or use it. Made up properly the better grade requires 39 pounds of glue plus 61 pounds of water to give 100 pounds of liquid glue ready in the pot for joining hard wood, says the Wood-Worker. From the cheap glue we must take 42 pounds of glue plus 58 pounds of water to get our 100 pounds of glue liquid. The better glue requires 10 per cent less glue, but 10 per cent more water in order to get the same quantity of liquid from both, namely 100 pounds of exactly the same fluidity of body.

The difference between the two glues in regard to strength is fully as large as the difference in spread. The better grade carries a strain of at least 47 pounds, while the other only resists 39 pounds.

To get the cost multiply the required number of pounds of dry glue with the price, and we have the cost of 100 pounds of liquid. For the joint glue we need 39 pounds of glue (and 61 pounds of water) costing 12 cents per pound dry glue, or $4.68 for 100 pounds liquid glue. For the lower grade we must take 44 pounds glue (and 56 pounds of water) at 9 cents per pound dry glue, at a cost of $3.96 for the 100 pounds in the pot.

Both glues give the same quantity, namely 100 pounds of liquid of exactly the same body, and the 100 pounds glue liquid from either will, of course, cover exactly the same surface. To use the better grade costs $4.68; to use the lower grade, $3.96, or 72 cents less. The cost is in favor of the lower glue if the strength of the dork done is to be ignored, but for the general use of the wood-worker the better grade will, in the long run, be found the cheaper.

## TO TELL THE POWER OF YOUR AUTOMOBILE.

**Rational Basis for Comparison of Motors Suggested—C. P. Instead of H. P.**

When we see two carriages of about the same weight driven by motors of the same rated horse-power, and one makes the other an "also ran" in a five-mile race, says Frank C. Hudson in the Automobile Magazine, we think of three possible explanations—supposing the motors to be working well. These are: Better handling by operator, less loss in transmission of power to wheels, or larger horses in the power rating.

A rational basis for the comparison of motors is suggested. The quickest method is to consider cylinder volume as the diameter squared multiplied by stroke, which, while not accurate as to the volume, would do well for comparison as cylinder volumes vary by the squares of their diameter.

Take two carriages, one with a 6 by 6 cylinder, 800 revolutions, weight 1,800 pounds; the other a double cylinder 4 by 4 motor, 1,200 revolutions, 1,200 pounds weight.

The first is

$$\frac{6 \times 6 \times 6 \times 800}{10 \times 1{,}800} = 9.6 \text{ Rated Power.}$$

The second is:

$$\frac{2\,(4 \times 4 \times 4) \times 1{,}200}{10 \times 1{,}200} = 12.8 \text{ Rated Power.}$$

Increasing the weight of the second carriage to 1,600 pounds would bring them both to the same rated power.

As this is not really the H. P. it might avoid confusion to designate it as the C. P. or comparative power instead.

## FIGHTING SNOW IN THE ROCKIES.

### Where the American Railroad Man Proves His Supremacy Above All.

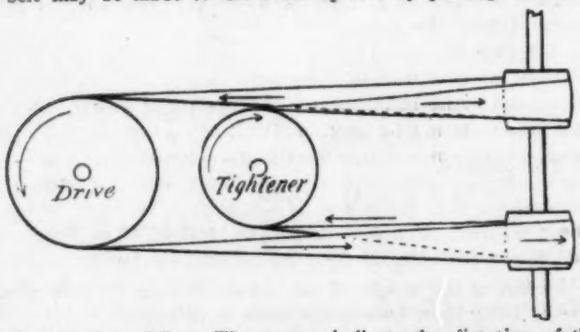
Heavy snow storms that have prevailed throughout the northwest of late have brought into use all of the latest inventions in snow plows. Many railways have beeen completely submerged for hundreds of miles. In the drifts from mountains and hills the snow has been so deep that even the giant plows are almost completely submerged.

The annual battle of snow in the Rockies is regarded as the

supreme test of American railroading and the successful issue every year is the best proof that the yankee railroad man is the pluckiest as well as the most scientific in the world. Railroad men of today wonder how they ever got along without the rotary snow plow, just as up-to-date mining men wonder how they ever made any headway without the air drill. There are certain passes in Colorado and Wyoming that are the bane of the hardest snow fighters in the world. Among them might be mentioned Alpine Pass, Boreas and Sherman hill. The accompanying cut from the Railway Review, shows a snow plow at work, pushed by two locomotives.

## TO MAKE THE BELT DRIVE THE SPINDLE.

The accompanying cut from the Wood-Worker illustrates how a belt may be made to drive the spindle by passing over two




pulleys and one idler. The arrows indicate the direction of the pulleys and the belt. To make the spindle run in the right direction care must be taken not to pass the belt on the wrong side of the spindle when the belt is put on.

## ONLY SALVAGE GRAIN DRIER IN THE WORLD.

### While It Has a Vociferous Smell; It Is a Boon to the Underwriter.

Chicago is the home of the only salvage grain drier in the United States and probably in the world, operated for grain owners and underwriters. There are other grain driers, but they will not handle this kind of grain because of its offensive odors. But Chicago, the city of the stock yards and packing houses, does not mind malodorous smells. Beside this grain drier, however, Armour's Packing House would smell like a perfume factory.

The drier seems to work wonders. Wheat spoiled to such an extent that it could scarcely be given away, undergoes a treatment as a result of which it has sold for as high as 58 cents. It will dry any kind of grain, no matter how wet or soft. The grain, after going through the process, will keep perfectly and may be stored or shipped anywhere. The dried grain still retains a degree of its smell, though, and for this reason is only fit for feeding.

The grain shipped to the drier, is shoveled out of the car over an oscillating screw, which separates from it all the pieces of charcoal, sticks, etc. It drops from there into an elevator leg (a wide rubber belt fitted with cups and buckets) and this carries it up to the top of the brick structure, 42 feet high, to the drier. The drier consists of a series of racks into which the grain drops by gravity, and disposes itself into vertical columns. Hot air blown by a fan through steam coils is forced through the layers of grain, which causes it to dry. Then the operator by throwing a lever drops all the grain into a lower section of racks, where it is submitted to a similar treatment of cold air. Then the grain is dropped out of the drier into a horizontal conveying belt which carries it into an elevator proper and delivers it into a second elevator leg. This carries it up and deposits it in a storage bin. From here it is carried to a separating bin where it goes over a series of screens. In its passage a constant blast of air takes out all the dust, chaff and light grains. From this it goes into the scourer (a horizontal iron drum), which revolves in a body of grain. It removes all the mould and foreign substances adhering to the grain. Then the process is over and the grain goes into storage or is loaded into cars for shipment.

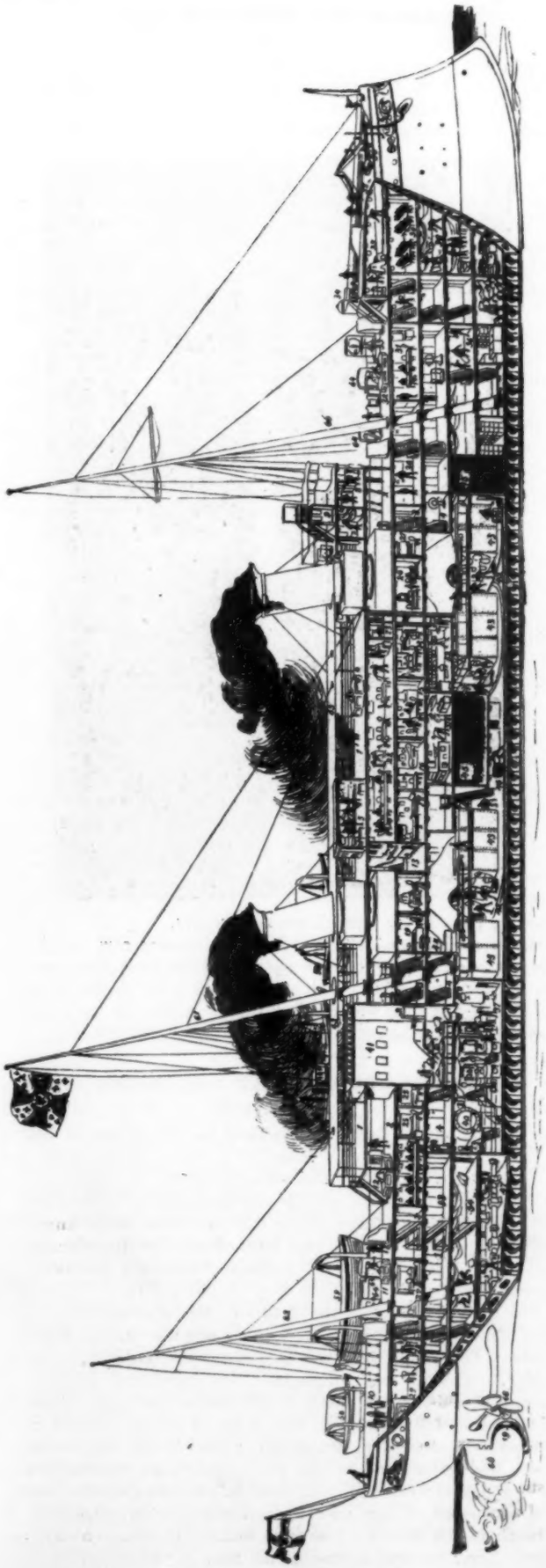
It requires just 1½ hours for the grain to be transformed from the wet state in the car to the finished, dry, hard, but still bad-smelling grain in the storage bin.

## NORTHWESTERN ADOPTS NEW SIGNAL CODE.

### Red Displayed in Any Way Means Instant Stop. Green for Special Trains Abolished.

The standard code of railway signals, known as the American Railway association code, has been adopted by the Chicago & Northwestern Railway. The object of the railway association in deciding on a standard code was to make it possible for a railway man to work on any road in the country without the necessity of learning new rules when he changes his service. The system, it is believed, will materially lessen the probability of accident.

The change on the Northwestern will be gradual and will be made so that the men will become accustomed to the new rules in sections. Green signals have been abolished in so far as their use indicated a special train, and white signals have been substituted therefor. When the code is in full operation a display of a red signal will indicate an instant stop. The color red will be eliminated except to indicate danger. The next change will be in the character of the light to indicate sections of trains.



HOW THE YACHT WOULD LOOK IF SPLIT LENGTHWISE.

1—Promenade Deck; 2—Upper Deck; 3—Saloon Deck; 4—Steerage; 5—Smoking Saloon; 6—Skylight of the Dining Saloon; 7—Map Cabin; 8—Commander's Bridge; 9—Imperial Commander's Cabin; 10—Wheel; 11—Skylight for Secretary's Messroom; 12—Skylight for Messroom of Suite; 13—Staircase to Imperial Apartments; 14—The Blue Salon (largest apartment); 15—Room Where Prince Henry Receives Reports; 16—Prince Henry's Own Office; 17—Prince Henry's Bedroom; 18—Prince Henry's Toilet Room; 19—Prince Henry's Bathroom; 20—Room of the Prince's Staff; 21—Room of the Staff; 22—Dining-Room; 23—Pantry; 24—Dumb-Waiter; 25—Cabin for the Suite; 26—Office of the Secretaries; 27—Cabin for Four Secretaries; 28—Pantry; 29—Steam Steering Engine; 30—Apartments for the Officers; 31—Officers' Mess; 32—Skylight, Officers' Mess; 33—Electric Search-Light; 34—Back-Board Lantern; 35—Anchor-Windlass ("gang-spill"); 36—Living Rooms of the Crew; 37—Engine Room; 38—Starboard Engine; 39—Back-Board Engine; 40—Condenser; 41—Airshaft of the Engine Room; 42—Boiler Rooms; 43—Starboard Boiler; 44—Back-Board Boiler; 45—Coal Bunkers; 46—Narrow Gauge Railway for Coal; 47—Axle-Tree Tunnel; 48—Starboard Screw; 49—Back-Board Screw; 50—Rudder; 51—Imperial Kitchen; 52—China Closet; 53—Living Rooms for Engineers; 54—Living Rooms for Machinists; 55—Axle-Tree Deck; 56—Anchor; 57—Steam Launch; 58—The Commander's Steam Launch; 59—Life-Boat; 60—Foremast; 61—Mainmast; 62—Mizzenmast; 63—Sails; 64—Rapid-Fire Guns.

## THE HOHENZOLLERN, THE FINEST YACHT AFLOAT.

### Splendid Furnishings Include Silver Service Weighing Two Tons and Valued at $1,250,000.

None of the famous yachts owned by American millionaires can compare with Emperor William's Hohenzollern, which brings Prince Henry to this country. She is the finest yacht afloat. She is a big, broad, bark-rigged double funnelled ship, flanked fore and aft with lifeboats. She has blind ports where deadly guns lurk in their locked carriages ready for action. She has the same cliff-like look along the bulwarks as the Atlantic liners, the same deep-sea rake to her funnels, the same wide sweep to her saloon decks. From the port or starboard bow may be seen the Hohenzollern's teeth. There is the forward curve of the sub-marine ram, the warship appearance around the dead-eyes.

The Hollenzollern is built entirely of steel. She was laid down at Stettin by the Vulcan company. Her engines have a registered capacity of 9,460 horse-power. Her speed capacity is 20 knots an hour.

The splendid furnishings of the interior include a silver service valued at $1,250,000, the most magnificent the world has ever seen. The entire weight of the service is more than two tons. On the middle deck amidships are Kaiser Wilhelm's private cabins which Prince Henry now occupies. They are brilliantly lighted with electricity and fitted with telephones communicating with every part of the ship. The dining room on the main deck, is wide and spacious, seating 30 or more. The pretty family saloon in blue and silver is a favorite haunt of the empress when voyaging on the yacht. Close by is the Kaiser's council room. Adjoining is Prince Henry's private office. Directly opposite the kaiser's sleeping apartments is the luxurious boudoir formerly occupied by the empress.

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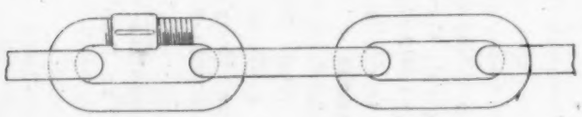
## CAUGHT 1,500 TERRAPIN IN ONE DAY.

Several years ago Carll Newcomb, a farmer and trapper of Cedarville, N. J., started a terrapin farm on meadow land which he owned, and at much expense and labor he gathered together nearly 1,500 small diamond-back terrapin. The New Jersey laws prohibit any person having in his possession terrapin less than four inches long. Nearly all of Newcomb's terrapin came within that limit. Although not of a marketable size they were worth more than $2,000. The game wardens learned of Newcomb's novel farm, and they arrested him and confiscated the terrapin. Newcomb declares that he bought the terrapin from fishermen who caught them on the Delaware side of the bay, and that they were not a product of Jersey waters. He has begun suit for $10,000 damages for false arrest and the loss of his terrapin.

## DETACHABLE LINK.

We illustrate a recent invention showing a detachable link,



by means of which a chain may be broken apart without cutting any of the links. The detachable link is as strong as the others.

## SOME LITTLE THINGS.

It is a habit with most folk to discuss the biggest things of earth, yet the littlest things are quite as amusing. Here are a few little things: Ourselves and the alphabet on a pinhead. The littlest church is in the village of St. Lawrence, Isle of Wight. It originally had sittings for 12 people. The littlest kingdom in the world is Monaco. The littlest man on record was Philetas of Cos, who had to carry weights in his clothes to prevent his being blown away. The littlest navy in proportion to population is Mexico's. Twelve million people are "protected" by a "fleet" of two dispatch vessels, two unarmored gun vessels carrying one four-ton muzzle loading cannon and four small breech loaders, and five second class torpedo boats. This "fleet" is manned by 90 officers and 500 men.

## EAR OF CORN SEVEN FEET LONG.

An ear of corn seven feet long was exhibited by the Campbell Corn Drill Company, of Harrison, O., at the Cincinnati Vehicle and Implement show. The ear was not grown of earth's soil, however, but was made by the pasting of 49,462 grains of

CAMPBELL'S BIG EAR OF CORN.

corn on a huge wooden cob. All the grains were counted when the ear was made and a prize was offered for the nearest guess to the correct number. The prize was won by Collier Bros., of Millersburg, Ky., who guessed 49,463. Beside the ear stands James Campbell, inventor of the Campbell corn drill.

## AMERICA THE GREATEST GOLD NATION.

### All Records of All Countries Shattered by the Output of Last Year.

The records of all the gold producing countries of the earth were broken by the Unted States last year, when the country's product amounted to more than $80,000,000. The Union's closest rivals, Australia and the Transvaal, were left behind by several millions.

The greatest output of the Transvaal was in 1898 when the gold amounted to $78,070,761. In that year the United States produced $65,082,430 worth and the value of Australia and New Zealand's product was $62,294,481. The two latter countries reached the high water mark in 1889, when their gold output amounted to $78,755,372. In that same year the Transvaal's production amounted to $72,961,501, while that of the United States was $70,096,021. In 1900 the United States resumed first place a position she had often held in the more remote past. The production of that year was: United States, $78,159,674; Australasia, $73,467,110; Transvaal, $7,208,869. The low output of the Transvaal was because of the war.

## SCHLEY A STUDENT OF MECHANICS.

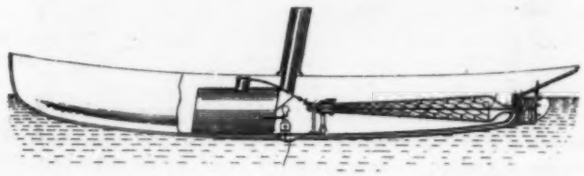
**Knowledge that Aided Him in Relieving Greeley and Punishing Korea.**

Admiral Winfield Scott Schley, who is a student of mechanics, is ever careful to see that every piece of machinery on his vessel is in perfect working order. To this is attributed the greater part of his success in relieving the Greely expedition of arctic explorers in 1884. After two well equipped expeditions had failed to rescue Lieut. Greely and his companions, Schley accomplished the difficult feat of making his way through the ice-packs to the missing explorers and saved them from their intense suffering and impending death.

When Schley was at the head of the assaulting column that inflicted the severe punishment on Korea for outrages on American sailors, he first looked to the machinery of his ships and saw that it was in first class working order. Thus the same invincible Schley, then (in 1871) a lieutenant commander, boldly attacked and destroyed the forts of the Sulee river. This, too, was years before the United States had a standing in the east as a world's power and after France had failed ingloriously in attempts to impose a similar lesson on Korea.

## NOVEL BOAT PROPELLER.

Our cut shows a recent invention for boats. Instead of the usual marine engine for turning the propeller shaft, a rotary engine is provided which consists of flanges mounted on the shaft. These flanges increase in size toward the stern to take advantage



of the utmost expansion of the steam. As there is no reciprocating motion the movement is continuous like a top or electric motor. Steam is admitted at the smaller (forward) end and escapes into the water at the propeller. Any type of boiler will answer, and a small steam pump to supply the boiler completes the machinery.

## INCREASES THE POWER OF STEAM ONE-THIRD.

**Sulphur-Dioxide Engine May Permit the Earth's Heat to Be Used for Power.**

The sulphur-dioxide engine invented in Germany has succeeded, without increasing expenditure, in securing one-third more power from a given amount of steam, according to the claims of the inventor. This engine is used as a supplemental engine, using sulphur dioxide as a motive power. The sulphur dioxide which volatilizes at a much lower temperature than water does, is turned to vapor by the heat of the exhaust from a condensing engine and accomplishes the additional work. It is believed by some engineers that the new invention may in time enable man to obtain from the hot center of the earth a source of supply for all the power that may be needed for heat, light and mechanical work on the surface of the globe. How this may be accomplished, according to opinions, will be told in a succeeding issue.

The United States output of coal now exceeds that of Great Britain, which country up to two years ago was the largest producer in the world, and the total of all grades will be 275,000,000 net tons this year.

## BEATS ALL KNOWN RECORDS OF FAST TIME.

**Fournier's Automobile Shoots Along Country Road at 80 Miles an Hour.**

Faster than the fastest train ever sped over rails; faster than any vehicle on wheels ever traveled, was the time made by Fournier in his winning race between Paris and Berlin, if Fournier's claims be true. Eighty miles an hour is the speed he is said to have made on the best roads. The average time from Paris to Berlin, 745 miles, was 43 miles an hour. Walter Wellman says:

"Eighty miles an hour! Can you understand what that is? A mile in 45 seconds. The fastest single mile ever made by a locomotive was in 32 seconds and that was on the best of steel tracks with a sharp down grade. But here is a mile in 45 seconds on a country road.

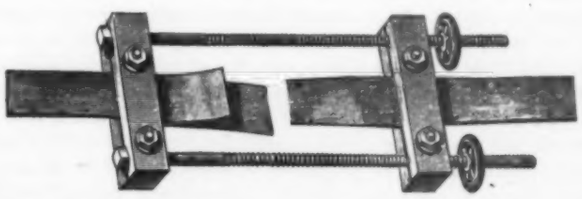
"Imagine yourself in the seat with Fournier. At forty miles an hour your eyes, if unprotected by goggles, weep like Niobe, and the tears, instead of coursing down your cheeks, run back upon your temples. At fifty miles an hour unprotected eyes go blind. At sixty miles an hour a pebble in the path may cause the great racer to leap like a panther. At seventy miles an hour one cannot hold to his seat without seizing and gripping something. At eighty miles an hour only the hardiest of chaffeurs, like Fournier, can keep breath in body without the use of a face mask that covers nostrils and mouth.

"At eighty miles an hour you travel the length of an American passenger train while turning your head for the swiftest sort of glance at the fleeting landscape. At eighty miles an hour one would travel from New York to Chicago in eleven and a half hours."

## TO MAKE A BELT ENDLESS ON PULLEYS.

It often happens that both pulleys over which a belt must pass are on shafting which is supported on pulley blocks. This necessitates the joining of the ends of the belt in place. To do this a belt clamp is generally used, in the following manner:

Place each end of the belt in the clamps, as shown in the cut. Be careful to place the ends of the belt in the clamps with a square; screw down the nuts tight so the clamps cannot slip on the belt. In drawing the ends together draw both sides equally so as to make a straight joint. Draw the belt taut, and



don't be afraid of breaking it, and when partly taut, turn the pulleys to get the belt on the pulley taut also; then draw the belt up taut again, taking out any stretch in it, and if the belt is too long cut off the ends of laps and prepare them the same as before cutting.

The best clamps for cementing are made of two pieces of 4 or 5-inch scantling, with a bolt through each end; cement the width of the clamps; slip the clamps over the part cemented, and draw them down by the bolts in the ends and let them remain a few minutes, then cement as much more, moving the clamps over the new cement and draw down as before, and so on till all is cemented. It is best to have the clamps crowned in the middle so as to make equal pressure across the joint.

Warm the glue or cement in any ordinary glue pot, and apply very hot with a brush. If the proper cement is used no rivets will be necessary.

# Easy Electrical Experiments

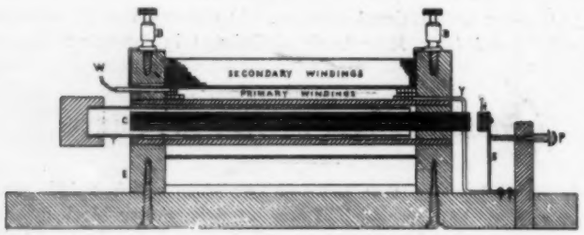
## FOR BOYS.

L. P. Dickinson.

### CHAPTER VI. HOW TO MAKE AN INDUCTION COIL.

A most interesting piece of apparatus and one that is quite easily made, is an induction coil. The present chapter deals with the construction of such a coil which may be used for medical purposes, or for general experiments.

An induction coil consists of four essential parts. These are. (1) a core of soft iron; (2) a primary coil of a few turns, wound close to the core; (3) a secondary coil of many turns wound outside the primary coil, but separated from it and (4) a device for rapidly making and breaking the current which flows through the primary coil. An inspection of the accompanying figure will show the relation of these four parts. The core "C" is made up of a bundle of soft iron wires, very straight, and accurately cut to a length of 4 ¾ inches. The wires should be bound together very tightly, forming a core, when completed, whose diameter is ¼ inch, measured just outside the iron. The




wrapping should be done with stout linen thread, wound very tightly and close together, leaving however a bare space at one end of core for a distance of ¾ inch from the end.

For the shank of the spool which is to support the coil, make a wooden cylinder, ⅝ inch outside diameter, and 4 ½ inches long, with a ½ inch hole through its entire length. This leaves a thickness of only 1-16 inch for the material forming the spool, and is in consequence a little difficult to make. The best way is to bore a ½ inch hole lengthwise through a block of wood of considerable size, and then turn or whittle the block down until it is of the required outside diameter. For the heads of the spool take two pieces of whitewood, ½ inch thick and 2 inches square, and bore in the center of each a ⅝ inch hole. The shank just constructed should fit tightly in these holes and be glued in place, forming a spool with square heads and a round shank, with a ½ inch hole running throughout its entire length.

The iron core first made, is supported from one end only, in the figure the right hand end. Make a plug, slightly tapering, which will just fit the ½ inch hole in the end of the spool. Bore through its center a hole which will fit tightly around the iron core. Drive the core into the plug, and drive the latter into the hole in the end of the spool, making a tight fit in each case. The core will then be supported by the plug, and should project ¾ inch from the end of the spool.

We are now all ready for making a device for varying the strength of the "shock" obtained from the coil. This consists of a tube shown at "T", which is made of metal and slips over the iron core, and into the inside of the hole in the wooden spool. This is why we supported the iron core from only one end, so that we could leave the other end free for the insertion of this tube. Procure some very thin sheet copper or brass, or even tin, and bend some of it into the form of a tube 4 ½ inches long and 7-16 inch in external diameter, and solder it smoothly. It should slip easily into the space between the iron core and the spool. The soldering is very important for the proper working of the coil. Perhaps some of those who read this may be so fortunate as to secure a thin piece of brass tubing at a hardware store, of the proper dimensions. If so, this is much the best plan. Fit to one end of the tube a wooden handle, and adjust the tube until it slides in and out freely in the space provided.

Upon the spool wind three layers of No. 18 double cotton covered magnet wire. The ends should project through small holes in the head of the spool. This forms the primary coil. Wind two layers of stiff writing paper outside this, gluing it in place, and paying special attention to the ends of the spool where the paper should fit tightly against the heads. Outside this wind 5 oz. of No. 36 double silk covered magnet wire. This ought to make a secondary coil of a depth of about ⅜ inch. Connect its terminals to two binding posts "B" as shown. Be very careful in handling this wire, as it breaks very easily. Do not try to wind it from a loose coil, as it is sure to snarl and break. Support it upon a reel or spool from which it may be directly wound to the coil. The inside terminal of this secondary coil should pass through a small hole in the end of the spool. This is necessary to prevent short circuiting the coil.

The circuit breaker shown at "H" is made of a piece of soft iron attached to the very thin spring "S", which is screwed to the baseboard. Pressing against this is the screw "P", made of brass, and supported as shown. Connect one terminal "Y" of the primary coil to this spring. Connect one pole of a strong battery to "P" and the other to "W" and the hammer "H" will begin to fly back and forth very rapidly, making and breaking the circuit between "S" and "P" at every movement. It may be necessary to turn "S" so as to secure the proper relation between the different parts. The hammer "H" should be about ⅛ inch from the end of the core.

On connecting two wires to the binding posts marked "B", a current will be obtained capable of giving shocks to the persons holding the wires. The strength of these shocks may be varied by sliding the tube "T" in and out, the shocks being the weakest when it is pushed in as far as it will go.

(To be continued.)

### DESPERATE FIGHT WITH A PIANO.

#### Paderewski Has a Narrow Escape in His State Room During a Storm.

A fight with a piano that came near proving disastrous to the greatest of pianists, occurred on shipboard while Paderewski was on his way to New York a short time ago. Paderewski in his state room had a small upright piano on which to practice. It was fastened to the floor by means of bolts. On the opposite side of the room was the bed. In a heavy storm the piano was loosened by the rolling of the vessel. Straight it made for the pianist and crashed into his bed, nearly pinning him to the wall. Paderewski on reaching the floor rushed to the opposite side of the room. Instantly the piano followed, coming at him with great force. He dodged it, but it came at him again, being hurled about in the room by the rolling of the boat. The pianist tried to get out the door, but could not loosen the bolt and he was thus hemmed in with the tumbling piano which threatened to crush him to death every second. There was nothing to do but wrestle with the instrument. He grasped it as it came toward him again and after a lengthy struggle in which he was nearly exhausted, succeeded in binding it to the wall.

Few occidental cooks are aware that in discarding water in which rice is boiled, they are wasting what is regarded by the Oriental as the most nutritious part of the food.

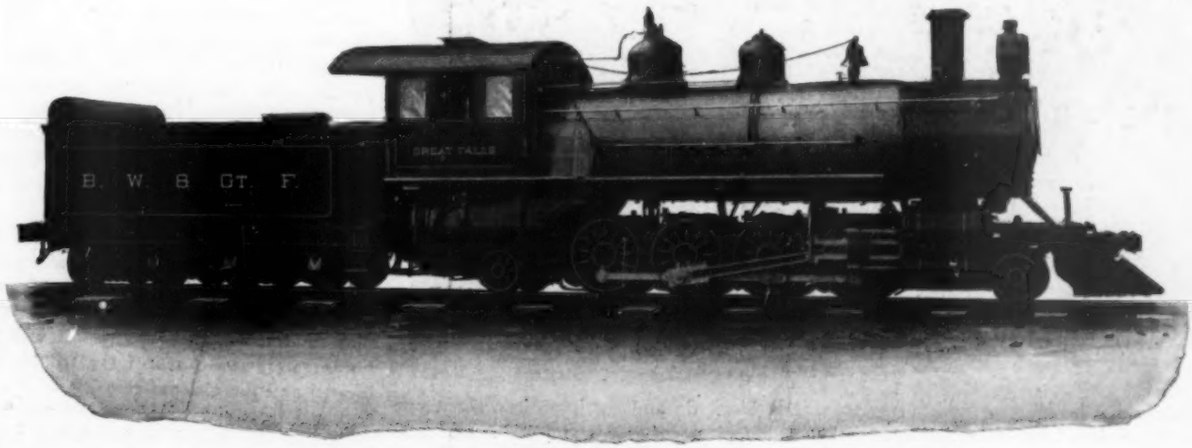
## LOCOMOTIVE THAT IS A MODEL OF GRACE.

### Handsome New Engine Built By the Baldwin Works.

In striking contrast to some of the clumsy locomotives that have recently been turned out by several European and American shops is the new engine that has just been built for the Washburn & Great Falls Railway by the Baldwin Works. With its extremely graceful appearance it combines durability and speed that at once proclaim it a formidable rival to the greatest locomotive inventions of the day.

It is a compound, eight-coupled, double-truck locomotive, weighing 166,910 pounds. Of this total weight 128,010 pounds rest on the driving wheels, 16,900 pounds on the front truck and 22,000 pounds on the back truck.

The cylinders are 14 by 26 inches diameter, says Locomotive Engineering. Balanced piston valves are used. The driving wheels are 50 inches outside diameter, and the main journals and others are 8 by 9 inches. The driving wheel base is 13 feet 3 inches, and the total engine wheel-base is 26 feet 11 inches. At the front course the boiler is 68¾ inches diameter. It carries a working pressure of 200 pounds to the square inch.




GREAT FALLS "ST. PAUL" TYPE.

This engine has been designed to burn lignite coal, and the firebox is made to burn this kind of fuel to the best advantage. It is 96¼ inches long and 84 inches wide. In the front it is 67¼ inches deep, and in the back 64¼ inches. There are 270 2-inch tubes, 16 feet 6 inches long. The firebox has 174 square feet of heating surface, and the tubes 2,322 square feet, making a total of 2,496 square feet of heating surface. The grate area is 56 square feet, which will provide a liberal surface for the combustion of inferior fuel. The tank capacity is 5,000 gallons.

## BLOOD POISON IS CURED BY ELECTRICITY.

A case is described in the Lancet where a surgeon accidentally pricked his finger during an operation, and became infected. The hand and arm began to swell and the surgeon became delirious. A needle attached to the negative pole of a fifty-cell galvanic battery was thrust deeply into the finger at the point of inoculation. Electrolysis, with the full capacity of the fifty-cell battery, followed for about one minute. After this treatment the pain and swelling subsided. Then strong galvanic currents were passed through the inflamed lymphatics by means of surface electrodes. Other electrical treatment followed and effected a cure.

The Colorado Cliff Dweller's association has been formed to preserve the cliff dwellings in the mountains of that state which are rapidly being destroyed by curiosity seekers.

## SHOP DRAWINGS AVERAGE $14 PER SHEET.

Interesting figures on the cost of shop drawing are given by Mr. H. G. Tyrrell in the Iron Age. During the 40 weeks in which the record was kept, 1,693 drawings were made at a cost of $23,815, making the average cost $14 per sheet. This cost includes the making and completing of shop drawings only, and is exclusive of outdoor measurements, strain sheets, general designs and estimates. Mr. Tyrrell says:

"Further investigation of the records showed that drawings made by the more experienced men, who were paid from $90 to $125 per month, cost much less than those made by younger and less experienced draftsmen. While the average cost of drawings for the whole office was about $14 per sheet, the cost of those made by some of the more experienced men went down to from $8 to $10 per sheet. This quite disproved the theory that cheap men meant cheap work. On the contrary, the cheapest work was done by men who knew their business best and consequently were paid the most. The reason for this is largely due to the fact that drawings properly made at first require but very little checking."

## SCHWAB'S POWER IS GREATER THAN A KING'S.

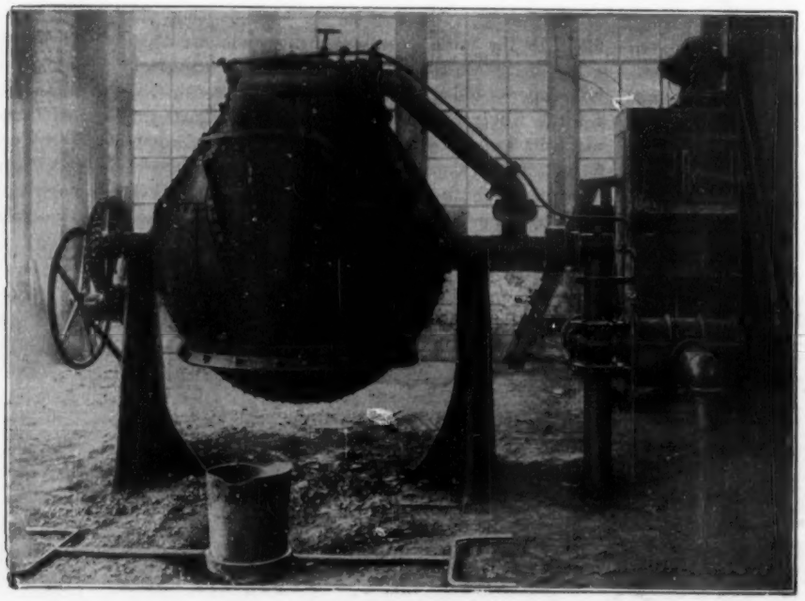
### Regal Sway Wielded by the Head of the World's Greatest Enterprise.

Greater than a king's is the power and suzerainty of President Schwab of the million-dollar United States Steel Corporation, and he rose from a day laborer—a stake-driver. Under him is an army of employes numbering more than 400,000. These men with their families make up a community of four million persons, dependent directly or indirectly on this mighty steel magnate. Only four states in the Union have so great a population as this. They are: New York, Pennsylvania, Illinois and Ohio. It is greater than the combined population of fifteen states of our country; thus he has under his jurisdiction a greater number of people than have the governors of fifteen states combined. But this is not all. He is the master of a fleet of more than 250 ships, nearly twice as many as comprised the Invincible Armada sent against England by Spain. He is at the head of three great railways; he controls 500 distinct plants, three of the greatest mineral ranges of the world, hundreds of mines, 30,000 coke ovens, thousands of gas mains, hundreds of gas wells, and so on, almost 2d infinitum, says the Saturday Evening Post, until the array makes one dizzy to think of it.

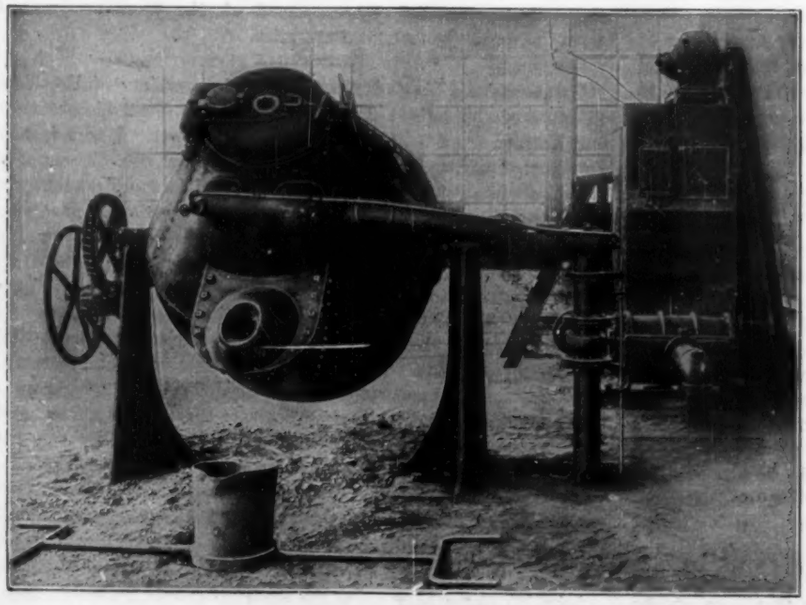
John W. Gates has bought the painting of "St. Paul" by Rembrandt for $75,000

## SMALL REFINING FURNACE.

A small melting and refining furnace for the melting of copper, brass, bronze, enamel, glass and similar substances has been built. It is known as the Schwartz furnace. In appearance and operation it is quite similar to the immense converters used in steel works, only this one holds 400 pounds while the others contain many tons. Heat is produced by oil which enters the furnace mixed with necessary amount of air which comes from a blower with a pressure of 100 pounds. Three hundred meltings may be made before the furnace lining of fire brick and clay must be renewed. To melt copper, brass or bronze requires one hour; malleable iron, three hours; gray iron, one and a half hours, and steel, six hours. The company's office is in the Marquette building, Chicago.



IN POSITION TO FIRE.



IN POSITION TO POUR.

## TO TEST SOLDER.

Good solder is easier bought than made, but if some distance from base of supplies buy block tin and cut it up into about one pound pieces, weigh it and put in an equal weight of lead. Melt in a ladle, stir it and run it off into a mold to cool. To test solder and find out whether it is of good quality, hold it up near your ear and bend it. If you can hear it cringe or a crackling noise it is good, and if not it is poor—too much lead and not enough tin in it.

## TO MEASURE TAPERING LOG.

As to the number of board feet in a stick of timber 4x4 inches at one end and 8x8 inches at the other, the stick being 24 feet long, there are two ways of arriving at a correct answer, says Mining and Scientific Press. Add the areas of the two ends to four times the area of the center section and multiply by one-sixth of the length; or, multiply the areas of the ends and extract the square root; to this add the areas of the two ends, and multiply by one-third of the length. The answer by either process is 74 2-3 feet.

## ELECTROCUTED THE CAT.

A cat climbed a trolley pole between Buffalo and Lockport, and tried to walk on the feed wire that brings the power from Niagara Falls. Her tail touched the parallel wire that carried the current back to Niagara Falls. There was a flash that could be seen for miles as the twenty-four thousand volts of electricity passed through her body, which fell across both wires and didn't drop to the ground.

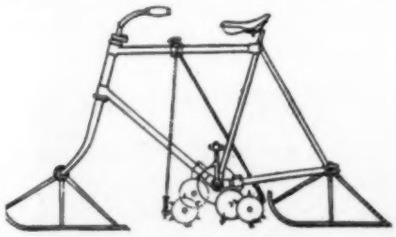
This short-circuited the current and caused a fuse at the Niagara Falls power house to be burned out. The power was immediately cut off from all the lines running out of the power house. It was two hours before the cause of the trouble was located and the charred remains of the cat removed from the wire. In the meantime almost all the electric railways and street-lighting plants in Western New York were without power.

## ELECTRICITY IN THE MACHINE SHOP.

In any machine shop, the absence of belts and of the necessity for having all machines in one line is a great advantage. Absence of belts enables the whole of machine shop to be swept by an overhead crane without inconvenience, and the absence of the necessity for having all machines exactly in one line practically increases the space at the disposal of the works manager. He can fit machines according to convenience, writes Sydney F. Walker, in the Engineering Magazine for February. There is a limit below which it is not wise to multiply motors in electric driving, and this limit will vary with each individual works; but it may safely be stated that, except in special cases, machines taking more than 4 horse power to drive will pay for separate motors, while there are cases where it pays even to divide up considerably more than this. Groups of machines turning out the same parts may usually be driven together, but the division in these cases should be such that the stoppage of one motor does not stop the works for the want of the particular parts.

### A WINTER VELOCIPEDE.

We illustrate a recent invention which an examination of the cut will readily explain. The usual bicycle frame and pedals are



employed and gearing transmits the power to contact wheels in which are sharp spikes for catching in the snow or ice. Instead of wheels, the machine is carried on runners.

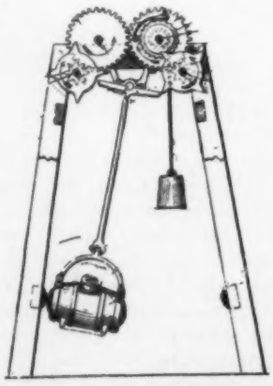
### HOW TO CUT THE TOE NAIL.

Cutting the toe nail to the quick has caused lockjaw and death, says the Shoe Trade Journal. The shape of the nail should follow the natural curve of the toe. If it be allowed to grow longer, it is liable to be forced back by the pressure of the shoe and grow into the flesh. Be careful, also, not to cut the nails of the toes too short, as in such cases the toes lose their natural support.

An agreement has been signed whereby rates between this country and England on three of the most important articles of export, grain, flour and produce, will be increased 50 per cent.

### PENDULUM CHURN.

A Texas inventor has designed a churn the motion of which is like the pendulum



of a clock. Power is secured by the running down of a weight which is first wound up by hand. One winding is intended to be sufficient for each churning.

In Syracuse, N. Y., the abandoned horse cars are sold and used for coal offices, lunch stands and children's play-houses.

### WORK IS HONORABLE.

A writer in the North American Review asserts that manual training is almost as good a preventitive of crime as vaccination is of smallpox.

"What per cent of the prisoners under your care have received any manual training beyond some acquaintance with farming?" a Northern man asked the warden of a Southern penitentiary.

"Not one per cent," replied the warden.

"Have you no mechanics in prison?"

"Only one mechanic; that is, one man who claims to be a house-painter."

"Have you any shoemakers?" asked the visitor.

"Never had a shoemaker."

"Have you any tailors?"

"Never had a tailor."

"Any printers?"

"Never had a printer."

"Any carpenters?"

"Never had a man in this prison that could draw a straight line."

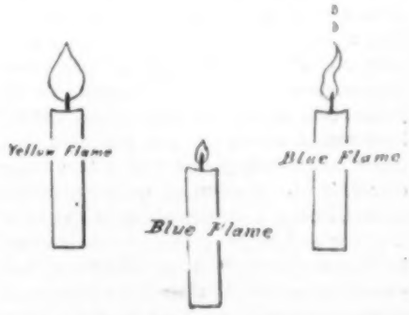
### AMERICAN AND EUROPEAN STEAM ENGINEERING.

In comparing the new station of the Metropolitan Street Railway of New York as a whole with similar installations in Great Britain and on the Continent, say with the Glasgow Corporation Tramways or Liverpool stations, or with the Berlin or Hamburg plants, it cannot be said that, taken as a whole, the comparison is entirely favorable to the 96th street plant. The individual items, such as engines, boilers, steam piping, dynamos, switchboards, transformers, are beyond criticism; but the putting together seems in many instances to have been not as carefully thought and drawn out beforehand as is generally the case with a European plant. No pipe, however small —no individual wire—is put into a European installation without a drawing being got out beforehand, says the Engineering Magazine. Great trouble is constantly being experienced with American goods owing to the drawings, which the makers have supplied and which have been approved by the customer, differing widely from the real article when it comes over. It seems impossible to convince the American that, no matter how small the detail, it has been carefully laid out on the plans before construction commences, and that a difference in the goods he supplies from the drawings approved will throw out the whole system. Indeed in some cases, particularly on the Continent, working drawings have to be approved by the police authorities, and the slightest deviation from them may entail the throwing out of the whole plant.

Kubelik, the violinist, cleared $22,000 for his four concerts in Chicago.

### EFFECT OF GASES ON CANDLE FLAMES.

Candles are used to considerable advantage by miners in determining the pres-




ence of inflammable gas. The accompanying illustrations are by Phil Rearden in the Mining Press. Fig. 1 shows how a candle flame will appear when no inflammable gas exists. Fig. 2 shows the appearance of the flame in the presence of inflammable gas, and Fig. 3 illustrates how the flame is affected by carbonic acid gas.

### WHEAT RUST IN FLOUR.

Rust is an occasional cause of variation in flour, says the American Miller. While it is true that rust is only communicated to the wheat berry in thrashing, yet the presence of rust has been detected in flour by means of the microscope. The cut shows wheat flour magnified 420 times. The letter a indicates the starchy parts and b the sporules of rust. While the damage by the presence of the rust is not particularly serious, the fact that the rust is communicated only through contact in thrashing and that rust sporules may be found in

flour from grain after the latter has gone through the whole cleaning, grinding and bolting apparatus of the mill, emphasizes the value of thorough cleaning.

French savants have criticised Marconi, claiming that in warm weather and warm climates the wireless messages will be greatly disturbed by atmospheric conditions.

## A LARGE BUSINESS IN IRON.

The Pittsburg correspondent of the New York Journal of Commerce says:

The events of this month in the iron trade strongly suggest that the present unparalleled prosperity is going to last not only through the first six months, but possibly all through this year. The oldest iron-masters in this city, notably B. F. Jones, Sr., Henry W. Oliver and others, have stated within the last few days that never in a single period during their long career in the iron trade were conditions as satisfactory and outlook as bright as it is at the present time. There is not a cloud in the business horizon anywhere, but everything points, in their opinion, to 1902 as being probably the best year the iron business has ever known.

The New York Central has decided to operate its trains through the tunnel with electricity. This will render impossible a repetition of the recent disaster.

A bill is to be introduced in the Iowa legislature providing for a standard for monuments and tombstones, so that they may not be over specified dimensions and cost.

Senator Hanna is in favor of the establishment of a government department of commerce.

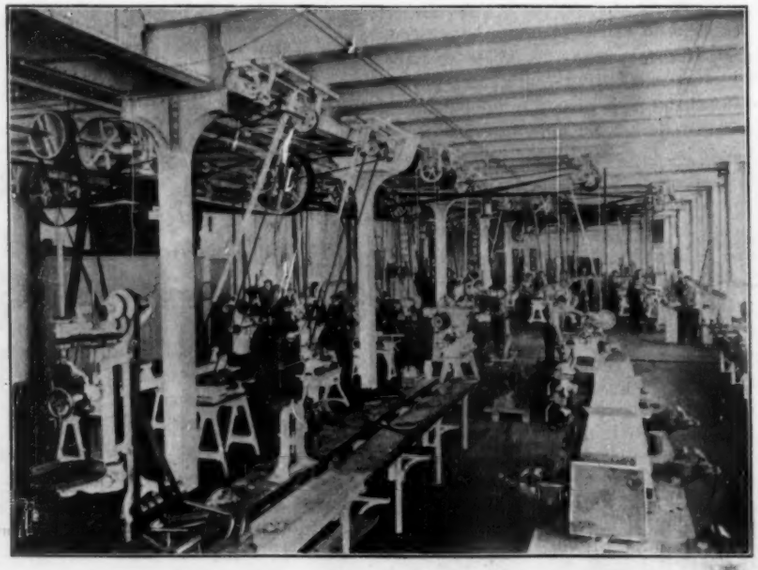
"To be sure," said the kindly minister to the man who lost both legs in a railway accident, "you have been seriously injured, but you must be grateful that your life is spared."

"Yes," said the sufferer, trying to look cheerful. "I can't kick."

## DOGS VS. COOKS.

Through the efforts of Miss Helen Gould a dog kennel costing $50,000, erected by her brother, will be converted into a building for cooking schools. The Hotel World very wisely says of this transformation:

"The supply of high bred and low bred dogs far exceeds the demand. We are long on useless canines but short on 'cooks' that know how to cook. Indeed, we could worry along very well if not another litter of fancy pups came into the world for ten years. But the supply of cooks grows smaller every year, and what little cookery we have has a tendency to drive men to drink."



Wood Shop.

## A SUMMER SCHOOL FOR ARTISANS.

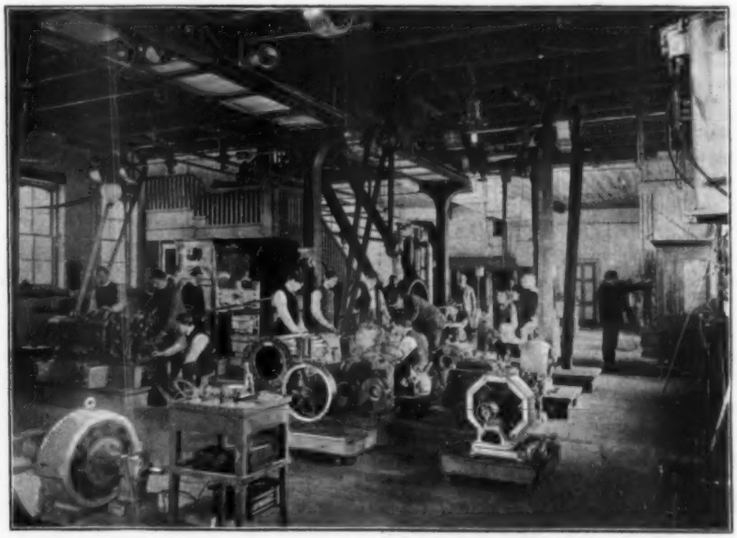
**Only One of Its Kind in the World.**

In the college town of Madison, Wis., where there are few factories or machine shops, may be found the home of the first Summer School for Apprentices and Artisans to be established in the world. It is under the supervision of the College of Engineering of the State University. So great is the need of such an institution in inventive and industrial America and so promising are the opportunities to the aspiring student of mechanics that the undertaking has attracted widespread interest throughout the country.

Machine Shop.

The first session of the school was held last year, lasting six weeks, July 1 to August 9. This year the session will probably begin and close at about the same dates. From present indications this is the beginning of a very great work in industrial education in America, and it is probable that ultimately special schools will be established for this purpose to be continued throughout the year in short terms of six or eight weeks each. It is now time for some rich man to endow such a school, for surely there is no class of education that could be of greater advantage to the American youth or to the American people. Such a school for Wisconsin should be located in Milwaukee, as the manufacturing center of the state. This is hardly the work for a state university, which can best devote itself to the fields of higher education.

This school was started purely as an experiment in industrial education. Dean Johnson and his engineering faculty felt that they could render a service to stationary engineers, superintendents of power stations, machinists and artisans of various



DYNAMO LABORATORY.

trades in the way of teaching mechanical drawing, the use of simple mathematical formulae, the scientific use of steam and electric power machinery, and of machine tools. The proposition to do the work of this character under the direction of a part of the faculty of the College of Engineering during six weeks of the summer vacation, was approved by the board of regents, and $1,000 was appropriated to pay part of the expenses. A fee of $15 was charged, and laboratory and shop fees of five cents per hour for all work taken in the shops and laboratories. The total income proved nearly sufficient to cover the cost of instruction and of material consumed. The number in attendance was sufficient to keep the teaching staff fully employed. Larger sections in the steam and electrical laboratories would have required additional instructors.

The departments of instruction in operation last summer were: Elementary Mathematics and Mechanical Power Transmission; Steam Engineering; Applied Electricity; Mechanical Drawing and Manual Training Methods; Forge Work; Machine Work and Wood Work. The school is equipped with complete electric dynamo and motor laboratories, steam laboratories, testing materials laboratories, shops and mechanical drawing departments, all of which are fully equipped with the latest and best forms of apparatus and machinery for instruction purposes. A descriptive bulletin can be obtained by applying to J. B. Johnson, Dean of the College of Engineering, Madison, Wis.

ELECTRO-CHEMICAL LABORATORY.

## CHICAGO-TEXAS EXPORT OIL CO.

### Men Who Have Been Leading Factors in Developing the Great Spindle Top Field.

Your attention is directed to the advertisement of the Chicago-Texas Export Oil company, which appears on the last page of this issue. This company have made one of the greatest records in the development of property yet shown in that wonderful field, Spindle Top Heights. They have succeeded in bringing in a splendid gusher which has a capacity of about 75,000 barrels a day.

The company expect during February to complete pipe-line connections, purchase of tank cars, contract for storage reservoirs, etc. In view of storing one barrel of oil for every share of stock sold, each reservoir holds from 100,000 to 150,000 barrels of oil. They also expect to complete contracts for another well on Spindle Top Heights, also to close present negotiations for the sale of oil which will pay April dividends and to negotiate for the shipment of oil to Europe.

In the history of the development of Spindle Top Heights, no company makes a better showing than this one in the limited time they have had for operations. The success of their efforts is in a large part due to the fact that the officers are experienced oil men, giving them every advantage in their negotiations and saving the company large amounts in furnishing its equipments, and in giving assurance that the affairs of the company will be wisely managed and early returns had for all stockholders.

Read the papers and keep in touch with the wonderful developments coming from that field. You will then see that shrewd investors from every part of the country are now picking up these stocks, as the next 90 days should witness the greatest development our country has ever known in that section. Only transportation facilities are necessary to make it the greatest wealth producing section in the world and this will soon be provided as ship yards and car factories are crowded months in advance, with orders for boats and cars to handle the mammoth output of oil.

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The Chicago and Eastern Illinois Railroad is preparing to install a system of electric signals to prevent accidents. The device displays a signal in the cab of the locomotive. The track is wired in blocks, the rail being used as the conductor. When there is only one train in a block the signal in the cab will burn white. Should another train touch the same block the light is instantly changed to red.

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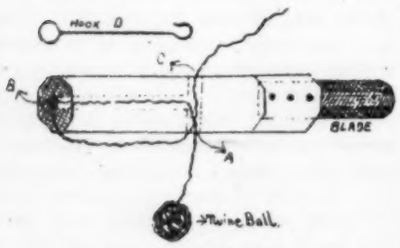
Barking Town is the noisy name of a village in England.

## TWINE HOLDER AND KNIFE.

The American Miller describes a home made device, easy for any one to construct, which saves labor where much tieing is done with string. The writer says: "For handle use a piece of hardwood 4 inches long, 1 inch wide and ¾ inch thick, and round off the corners. For the knife I used a piece of an old table knife and drilled holes through the handle and blade




HANDLE AND BLADE

for rivets. In about the center of the length of the handle I bored a hole in line with the blade, and then another hole from the end of handle until it connected with the cross hole.

To thread the knife I bent up a wire hook. This I inserted in the hole B, passed the end of twine up hole A and

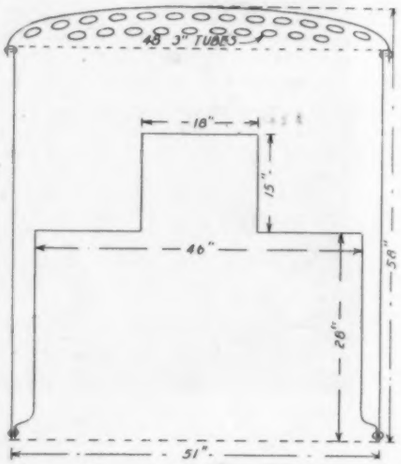
drew it out at B by means of the hook. then passed the twine around to A and drew it out at C, when it is ready for use. I use 4-ply ball twine, and after getting the tool threaded can use the whole ball without cutting off more twine than is needed for each sack as it is tied. To use, take the knife in the left hand, with twine from ball end between the second and third fingers, and proceed to tie the customary knot, which every miller should know how to make.

## HOW TO ASCERTAIN RADIATION.

Here is a sketch of a steel boiler which is to be brick encased, the idea being to have the flames pass through the flues around the boiler to front, passing down and then back again, to the rear of the boiler and out through the chimney. The dimensions are as follows: Height of shell, 58 inches; diameter of fire pot, 46 inches; diameter of shell, 51 inches; number of tubes, 48 three-inch tubes, 30 inches long, tubes measuring on the outside. The height of fire-pot from grate is 28 inches. The combustion chamber is 15 x 18 inches in diameter. Kindly advise us how many feet of radiating surface this boiler will supply with steam at three pounds pressure. Also how many square feet radiating surface boiler will supply with water at 185 degrees of temperature. This is the question asked by a subscriber of the American Artisan, and the following was the reply:

A boiler constructed as shown in the sketch herewith, as per measurements given, counting all exposed surfaces, would contain just about 200 square feet of heating surface. According to the custom of ascertaining the heating capacity of house-heating steam boilers, 15 square feet of boiler surface is called one horse-power, and under favorable conditions, such as using a good grade of coal with a proper draft, as well as the necessary grate surface, the one horse power is known by practical tests to supply 100 square feet of direct radiation with a pressure from two to four pounds per square inch. And as this boiler has a surface of 200 square feet divided by 15, gives us 1333, which is the amount of direct steam radiation the boiler should supply.

To determine the capacity of the boiler for hot-water radiation at 185 degrees temperature.—Knowing that steam at four pounds pressure gives a temperature of 225 degrees, which is 40 degrees higher than water at 185 degrees and which is leaving out a small fraction, 1-6 less than the steam in degrees of heat, we now divide the steam capacity of the boiler, 1333 feet, by 6, which gives us 222, and this is the amount of extra radiation for water over that of the steam which the boiler will supply, and which is direct water radiation at 185 degrees, 1555 square feet. It is the custom among boiler men and it holds good, to allow one-third more radiation for water over the steam rating of a boiler, and when we calculate on steam at 5 pounds pressure and on water at 180 degrees, this allowance of one-third extra surface for water will be found practically correct. An important feature in proportioning boilers is to have the grate area to correspond with the heating surface, and this, too, has been ascertained by many practical tests, safe enough to follow, which is to allow one square foot of grate for 36 square feet of boiler heating surface, and, according to this, 5½ square feet of grate would be ample for this boiler, although six square feet of grate surface would be satisfactory, and therefore, the boiler in question, having a grate surface




of about 11 square feet is just about one-half too large for its heating surface, for economy in the consumption of fuel.

The following has been adopted by the Carbon Club:

Ratings of steam boilers are based on a standard of two pounds steam pressure at the boiler and a standard of water 180 degrees temperature at the boiler. If boilers in operation come up to the set standards, the guarantee of the manufacturer is fulfilled, and any further difficulties must be settled by the contractor. The ratings also include the surface exposed in supply and return pipes. So that if a job requires 1,000 feet of direct radiation, the amount of surface exposed in the piping must be added to determine the size of boiler required. In an average job of steam or hot water, the piping will expose about 25 per cent of the surface in the radiators, or in a job that requires 1,000 feet of radiation, 250 feet, making a total of 1,250 the boiler must carry, hence a boiler of that capacity must be purchased. Then, if the job, when completed, shows the two pounds steam pressure, or 180 degrees water temperature at the boiler, it has fulfilled the purpose for which it was sold, and the manufacturer's responsibility ceases.

An Irishman who had been having some experience with cheap furniture from an installment house was called to the witness stand in a suit for the balance of a bill due on a purchase similar to one he had made. One of the questions in dispute was the quality of the goods, says the Wood-Worker. The lawyer asked him if he knew what quartered oak was. "Yis, sor, I do; 'tis three-quarters poine."

Denmark has formally agreed to sell her three West Indian islands to the United States.

MACHINERY, ENGINES, SHAFTING, & & & PIPE.

Everything in wood and iron used in constructing and operating; new and second-hand (rebuilt), cheaper than you can buy anywhere else. Write us first.

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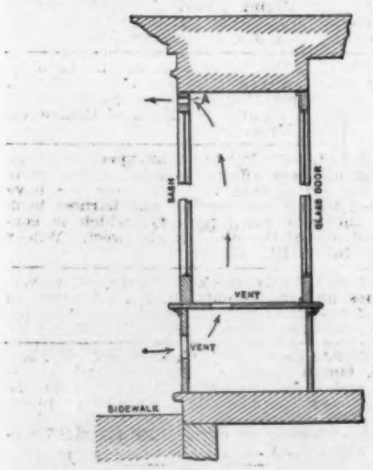
COLDBURN Is a Salve which if promptly applied will cool

all ordinary burns from fire, hot iron or hot water, and will absolutely prevent blister. Takes out all the burn in from one to five minutes. Will not cure everything, but is excellent for reducing inflammation and healing many chronic sores, chapped hands or lips, etc. Is made of the purest vegetable products only, and is perfectly harmless. Excellent for tightness of the throat or chest. Although in use for many years, is now put on the market for the first time. Once used, always wanted. Sent postpaid anywhere, 25 cents. If not as represented money cheerfully returned. Address

COLDBURN, Room 604
162 Washington Street, - Chicago

## TO PREVENT FROST ON SHOW WINDOWS.

Frost on show windows in which gas lights are burned may be prevented by the following construction, according to a contributor to the Metal Worker: The sketch represents a vertical section through the show window indicating the method of ventilation. An 8 by 10 inch iron ventilator was inserted under the show window facing the street and ventilator of the same size was placed in the floor of the

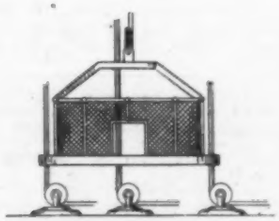



show window. The arrows indicate the direction of the currents, the fresh air entering at the bottom and the hot air escaping at the top through holes made in the window sash. The holes indicated by the letter A, were one inch in diameter and were placed every six inches across the top of the window. The ventilator might be made with closing shutters so as to regulate the draft. The store in question is occupied by a dealer in Japanese fancy goods and the window has four gas lights.

## BALLOON OBSERVATORY.

An inventor in New York state has devised a novelty which he thinks will be useful in military operations, expositions or other places of outdoor amusement.

Instead of being obliged to draw the observation balloon to earth each time the



observations are through, he anchors the balloon and uses an elevator cage for the ascent and descent. The usual elevator features are employed in the construction and operation of the cage, the principal difference being that wire ropes are used as guides for the cage. On reaching the balloon the party can leave the cage and walk about on the observation platform.

Popular Mechanics contains the best of the best things published in the mechanical papers of the world.

## THE REWARD OF PATIENCE.

Old Bill Jones,
He used to kick,
An' never worked
A single lick.

An' Hiram Smith
Worked night an' day,
An' never had
A word to say.

When workin' Bill
Seemed at a loss,
An' so they had
To make him boss.

An' Hiram, he
Works with a will,
A tryin' hard
To please ol' Bill.

—Washington Star.

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TO ALL STOCKHOLDERS OF

# CHICAGO-TEXAS EXPORT OIL CO.

The bringing in of our Gusher was announced in the Tribune of Feb. 7th.

READ THESE TELEGRAMS:

Beaumont, Texas, Feb. 6, 1902.
Chicago-Texas Export Oil Co.,
Your Gusher No. 1 in block 32 is in, and shows splendid strength.
R. OLIVER,
Pres. The Citizens' Nat. Bank.

Beaumont, Texas, Feb 6, 1902.
Chicago-Texas Export Oil Co,
First Gusher is in and proves as strong as any one on Spindle Top; daily capacity easily 60,000 to 75,000 barrels. Congratulations.
R. L. COX & CO.,
Drilling Contractors.

In accordance with the previous notice, a limited amount of stock is now offered at

## 50 CENTS PER SHARE

**NEXT** TO SELL OUR OIL. We can produce about 60,000 to 75,000 bbls every 24 hours, or on the minimum basis of 11 cents per bbl. at the well with minimum capacity of 60,000 bbls, $6,600 worth of OIL DAILY.

READ THIS: AND NEXT---TO PAY DIVIDENDS.

Beaumont, Texas, February 6, 1902

Chicago-Texas Export Oil Co.
Write us immediate authority to contract for sale of oil.
Sign President and Secretary. Can Sell enough for several dividends.
R. L. COX & CO.

SANFORD MAKEEVER, Fiscal Agent,
84 Adams st., Chicago, Ill.
Long Distance Phone, Harrison 1540


The steamer Grover Cleveland, plying between New Orleans and towns on the Louisiana coast, has been fitted with oil-burning apparatus, including oil-tanks holding 10,000 gallons. Her first trip marked a saving of more than 40 per cent in the cost of fuel.

Firemen of Harrisburg, Pa., have discovered that fire will melt ice. During a recent conflagration there a fire engine was stationed on the ice in the canal. The ice melted and the engine went through to the bottom. It required hours of laborious work to dig it out.


**The cuts used in this issue are for sale at very reasonable prices. Address POPULAR MECHANICS, Journal Building, Chicago.**


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FOR SALE—Five sets of 1-12 h. p. electric motor castings, for $1.00 per set. Photo for stamp. Roy A. Crihfield, Lincoln, Ill.

ENGINEER'S LICENSE—Mechanics, Engineers, firemen, electricians, etc., 40 page pamphlet containing questions asked by Examing Board of Engineers; sent free. Geo. A. Zeller, Publisher, Room 502, 18 S. 4th St., St. Louis, Mo.

FOR SALE—Job lot new electrical goods given us to sell; list for stamp. We handle everything electrical and at lowest prices. Stamp for catalogue. Dept. N., T. Binford Electric Works, 904 Washington Blvd., Chicago, Ill.

### POSITIONS WANTED.

SITUATION WANTED—Mechanical drafting and devices. 1705 Marquette Bldg., Chicago, Ill.

WANTED—An energetic, capable and experienced traveling salesman, having a large acquaintance with hardware and implement trade in ten states, desires position with responsible manufacturers. Address Box 33, Archer, O.

SITUATION WANTED—By a reliable young tinner with 12 years' experience at tinning and plumbing. Can plan and put up furnaces. First-class mechanic. Situation wanted west of Mississippi river. A. B. Curtis, care of Gen. Del., Sioux City, Ia.

WANTED—Position as traveling salesman with an implement, wagon or harvester company, by young man of strictly temperate habits. Address Morgan, Box 34, West Branch, Ia.

WANTED—Position to sell to the farm implement trade in south New Jersey by experienced business man, well acquainted with the territory. Very highest references. Want a first-class line. Jos. Alexander, Haddonfield, N. J.

SITUATION WANTED—By competent janitor, well recommended. Le Duc, 6050 Washington Ave., Chicago, Ill.

WANTED—By young married man, position in retail hardware; capable of taking entire charge. Address H. T. Cornell, care C. W. Hackett Hardware Co., St. Paul, Minn.

WANTED—Position in hardware store; 5 years' experience; 2 years in tin shop. Prefer small town. Any part of country. Address J. O. Harney, Lawton, O. T.

WANTED—A boilermaker. Address the Reliance Steam Boiler Works, La Crosse, Wis.

WANTED—Patternmaker. Chicago Bldg. & Iron Co., Washington Heights, Ill.

WANTED—Lady agents to sell an article needed by every lady; quick sales; good profits. The Como Supply Co., Lock Box 535, Minneapolis, Minn.

WANTED—Young man, experienced, to file metal. Sahlin Corset Co., 258 Franklin St., Chicago, Ill.

WANTED—Copper plate engraver. Address, stating age, references and salary wanted. Mermod & Jaccard's, St. Louis, Mo.

WANTED—At once, a good A No. 1 tinner; can do furnace, bicycle and pump work, and any work that comes along in a country tin shop; work all year, winter and summer. Write to Columbus Hardware Co., Columbus, Wis.

WANTED—Japanner, first-class in all details, for tinware work; state salary and experience. C. B. Emrich, 1053 St. Louis Ave., Kansas City, Mo.

WANTED—Wood patternmaker, good. Gale Manufacturing Co., Albion, Mich.

WANTED—Butcher, steady man, that can kill and work in sausage-room; regular work for right man. Henry Butler, Goodland, Ind.

WANTED—At once, tinner and all-round man; one who can do pump and windmill work. References required. Address E. J. Edwards, Alta, Iowa.

WANTED—First-class retail salesman who can sell hardware, stoves, vehicles, implements, furnaces, etc. Address J. W. Lingo, Lebanon, O.

WANTED—Salesman to handle an easy, quick seller; good commission; no competition, no sample needed. Write Hirsch Brothers, Milwaukee, Wis.

WANTED—Experienced and competent stove and range traveling salesman to sell the "Eclipse" line in Nebraska. Stock carried at Omaha. Address Eclipse Stove Co., Mansfield, O.

SALESMAN—For steam, hot water and hot air heaters; wide acquaintance with New England trade. "S. and H. W.," 70 Kilby street, Boston, Mass.

SALESMAN—In any line of metal work, thorough knowledge of manufacturing. 117-119 South Fourth street, Philadelphia, Penn.

BOOKBINDER—Forwarder or finisher, or foreman, in small city of Illinois preferred. Lock Box 284, Matttoon, Ill.

LAUNDRY MANAGER—Up to date, West preferred. Address Manager Dalton Steam Laundry, Dalton, Ga.

WANTED—Side line; for my men to handle on commission; I have men traveling all over the state. O. A. Rudolph, Canton, S. D.

### BUSINESS CHANCES.

NIGHT HAWK mining shares of the Winnacut Lake Mining District, Washington; an interesting proposition for investigation. Address Lock Box 970, Milwaukee, Wis.

SALMON RIVER mines booming. In deepening shaft, struck immense ledge of rich ore. Miners say that there are millions in it. Salmon River Mining Co., Bank of Commerce, Minneapolis, Minn.

FOR SALE—Owing to an unexpected change in our business affairs, and to enable us to give our entire time to other lines, we have decided to sell our carriage and harness business and rent our repository, which is considered one of the finest in the west. Wilcox Bros., Joliet, Ill.

FOR SALE—My stock of hardware, stoves, buggies and implements, in a good town, in one of the finest farming sections in Indiana. W. V. Britton, Hudson, Ind.

FOR SALE—A nice, clean stock of hardware, stoves, tinware, wagons, buggies, harness and farm implements; situated in the northwestern part of Ohio, town of Swanton, in Fulton county. Stock will invoice about $6,500. Address the owners, Brindley & Drennan, Swanton, O.

WANTED—A second-hand pipe tapping machine. Send me price and description. C. A. Bergh, Mondovi, Wis.

FOR SALE OR TRADE—Full or part, set of tinner's tools and machines, all in very fair condition. R. Z. Tracy, Irving Park Sta., Chicago, Ill.

FOR SALE—A No. 4½ Barnes' screw cutting lathe, complete with tools and chuck, etc., $35 (thirty-five) cash buys this machine. Wm. Matt, Fort Dodge, Ia.

FOR SALE—Tin shop, furnace and plumbing business; only one in town of 1,800—about 35 miles from Chicago, in Indiana. Address Box 158, Hobart, Ind.